Case Study
Walnut Hill United Methodist Church - Dallas, Texas
Chiller Replacement Analysis

Jim Phillips, P.E.
Sr. Engineer
Texas Utilities

ABSTRACT:
In March of 1992 Walnut Hill United Methodist Church in Dallas, Tx. decided that their existing thermal storage and electric reciprocating chiller system were both in need of replacement. After analyzing several options, they chose to install 150 tons of gas-fired double-effect absorption chillers. This case study will show the original HVAC operation cost analysis and compare it to the present day operation costs and it will describe how unexpected changes occurred that caused the initial analysis to be questioned. Finally, this case study will show how today's operational costs are lower than originally projected. *This presentation is not about the reasons the church chose this particular system, but about the analysis itself and its accuracy.*

BACKGROUND:
The church is approximately 52,000 sq.ft. consisting of a sanctuary, chapel, two educational wings, parlor, nursery, kitchen, and office area. The church held services on Sunday morning and evening and on Wednesday evening as well as operated a day school Monday through Friday. The cooling system consisted of a 50 ton reciprocating unit which produced ice for cooling the sanctuary and two other 50 ton reciprocating chilled water units (all R-22) for the rest of the church, with one supplementing the sanctuary needs on Sunday. Space heating was accomplished with a gas-fired hot water boiler which was operating at about 60% efficient. The church also had a 660 MBH (1,000 Btu/hour) hot water heater. Maintenance was handled "in-house" with contractors used for major repairs. The church needed to replace their old, high maintenance cooling units and also reduce their growing operational costs. They did so in May of 1992.

Several side benefits accrued to the analysis and the chiller replacement. First, it was learned that the church had the standard general service electric rate as well as the utility's "time-of-day" day rate used for thermal storage, but they had been applied to the wrong meters. The "time-of-day" rate was on the electric meter which served the building and the two reciprocating chillers and the standard rate meter served the ice storage system. Second, when the ice system was removed, it was found that condensation had eaten away all of the wood timber support and the brick wall was about to collapse. The wall was repaired during the installation of the new chiller/heaters.

THE ORIGINAL ANALYSIS:
Electric and gas usage data was gathered and collated in late March of 1992. The data showed that the church had an electrical equivalent full-load hour (EFLH) average monthly schedule of 239 hours per month which is a load factor of 33% on its larger

meter. The load factor peaked at 47% (130 kW and 44,160 kWh) in September and was lowest in April at 21% (113 kW and 17,360 kWh). Peak monthly kW was 130 while lowest monthly kW was 64. This produced an average cost of $0.0762/kWh or $22.34/MMBtu. The smaller meter had an average load factor of 16% and averaged $0.1259/kWh or $33.88/MMBTU. Maximum demand on the smaller meter was 61 kW in June and the lowest was 31 kW in February. Natural gas costs averaged $4.96/MMBTU with maximum consumption in January of 215 Mcf (MMBTU) and 12.5 Mcf in June. (Analysis attached #1).

In early April of 1992, the first HVAC operating cost analysis was completed. It showed an annual HVAC operating cost savings of $15,565 by replacing the existing heating and cooling system with a gas-fired double effect absorption chiller/heater. (Study attached #2). The gas company, as an incentive, would provide a lower gas rate for summer cooling of $4.00 instead of the existing $5.00 per Mcf and provide a cash incentive of $27,000 to buy down the cost of the chillers. Annual gas usage would increase from 936 Mcf to 2,363 Mcf. Electric consumption would decrease 163,515 kWh per year. This included the increased electric energy needed by bigger motors for the condenser water pump and cooling tower fan of the absorption system. The big savings came in demand charge reduction, which was 55% of the total annual electric bill. There were other minor savings in the absorption system (maintenance, space heating) and minor increased costs (water). This study was presented to the church and approved and the system was installed. Payback on the chiller/heaters was calculated to be just over three years.

RE-ANALYSIS:

In January of 1994 the Walnut Hill United Methodist Church questioned the amount of saving they were receiving. A review of the utility bills showed that the consumption and cost of natural gas matched the analysis predictions, but the electric demand, consumption, and especially costs were higher than predicted by the analysis. Researching the electric energy consumption revealed that the church had installed additional electric equipment (24 kW) after the chiller change-out and reviewing the electric rates disclosed that electric rates had increased in 1993 by over 25% for the church. It was the low load factor that caused such a large cost increase since it was the demand charge that increased significantly in the rate change.

The original study had projected an annual gas chiller consumption of 2,363 Mcf with an electrical demand of 50 kW and an energy consumption of 105,937 kWh. Actual 1993-1994 chiller consumption was 2,512 Mcf , 85 kW, and 100,500 kWh. Measurement of the electricity to the chiller plant and the main building revealed short peak usages on Sundays and Wednesdays. Average kW load at the main building was 10 kW with periodic peaks of 20-40 kW during the week and 70 kW for an hour on each Sunday. Average kW load a the chiller plant was 3 kW with 2-5 hour peaks of 10 - 15 kW each Wednesday and Sunday. It was determined that the church had been taken off the "time of day" rate when the thermal storage tank was removed. The church reapplied for the "time of day" rate which eliminated the 70 kW Sunday peak from being billed. (Demand graphs attached #3).

FAILURE:

In October of 1992, one of the gas absorption chillers failed and required

replacement. A new unit was installed and in operation three days after the failure. Since the unit was in warranty, the entire cost was born by the manufacturer. During the seven years of operation, other minor failures have occurred, especially to the auxiliary system of cooling tower and pumps, which were monitored by the chiller's electronic equipment and shut the chiller off so that it would not be damaged by the external failures. The minor internal failures were mostly electronic in nature and quickly repaired. In 1994 a chiller service company was given the responsibility for maintenance under a service agreement which included preventive maintenance service.

PRESENTLY:
In 1995, the gas company offered a new lower gas rate to the church. Deregulation of the gas industry had resulted in large facilities being able to purchase natural gas on the open "spot" market and paying a transportation fee to the distribution company. Walnut Hill United Methodist Church was given this opportunity, which they accepted. This provides a gas savings during the cooling season of almost $2,000 annually.

Since 1992 the cost of gas per unit of measurement to the church has decreased while the cost of electricity per unit of measurement has increased. Today, 1997, the annual cost savings to the church of 150 tons of gas cooling would be $19,249 instead of the earliest analysis of $15,565. Also, during this time, the analysis program has been improved and expanded, but the analysis concept of using the actual gas and electric rates has not changed which results in an accurate analysis. Even though annual usage of energy may vary due to differences in weather, this program will still accurately predict HVAC operation costs.

Comparing the original 1992 energy analysis (Attachment #1) to the last 1997 study (Attachment #4), the average cost of electricity has increased from $.0762 per kWh to $.0907 per kWh, an increase of 19%. Part is due to rate changes and part to the decrease in the church's electrical load factor from 33% to 27.6%. Although they are using less power (kW), they are also operating fewer hours. The analysis also shows that although they are using more natural gas (2,111 Mcf vs 936 Mcf), due to the gas chillers, that the cost per unit has been reduced from $4.96 per MMBtu to $4.10 per MMBtu. The original HVAC study, 1997 version (Attachments #5b-e), used 1992 electric and gas rates. The new 1997 HVAC study (Attachments #8a-c) uses 1995 electric and gas rates, which are the same as today's 1997 rates. Notice that rate changes have saved the church about $5,600 annually.

The 1997 HVAC analysis program (Attachments #5a-n) uses the original 1992 data. It allows you to compare it to the original 1992 HVAC program (Attachments #2a-d). As computers have advanced in their capabilities, so has the HVAC program. The report has increased from four to fourteen pages, graphs are included, each input subject has it's own page, and it is easier to change variables such as weather and rates.

Probably the most interesting comparison is its accuracy. Compare the gas consumption and cost of 1997's HVAC analysis (Attachment #6) to 1997's actual billing analysis (Attachment #4). The electric part of the analysis shows a similarly good comparison. With the 1997 building (lights, computers, clocks, machinery, etc.) electric

cost of $10,873 (Attachment #7), the 1997 chiller HVAC electric cost of $9,561 practically matches the 1997 actual billing analysis (Attachment #4) of $20,592, a difference of less than 1%. The gas analysis (Attachment #6) and actual bill (Attachment #4) difference is 4%.

Finally, it is interesting that there is not much difference in the HVAC costs due to weather differences of 1992 and 1997. Looking at the HVAC cost of 1992's data with the 1997 rates (Attachment #8a) and the HVAC cost of 1997 (Attachment #9a), only the weather data Attachments #5i & 9b) being different, there is only a $134 difference in operation cost.

CONCLUSION:

We are very pleased with this HVAC operation cost analysis program because it is extremely accurate. It has evolved with technology and rate changes, improving its looks and quality, but keeping its accuracy. It should be noted that the 1992 program was not the first of these programs, but it was an improvement over the original program run on a 1984 TI 59 programable calculator having only 10,000 memory bits on a magnetic strip. The 1992 program ran on a desktop 286 computer. Today's program is operating on a Dell laptop 166 Pentium with 84 MB of memory and a 2 GB hard drive. Old computer program, new computer program, both programs accurately matched actual gas and electric costs for the operation of HVAC equipment. It was not a program that ran by itself; it required good engineered input to produce good output, but it did not take a whole day to input the data either. The Walnut Hill United Methodist Church project was such an example.

CLIENT: WALNUT HILL UNITED METHODIST CHURCH DATE: 31-Mar-92
CONTACT: JACK JOHNSTON OTHER THAN SANCTUARY JIM PHILLIPS, P.E., CEM
CITY: DALLAS LONE STAR GAS CO.

ELECTRIC COMPANY - BILLING ANALYSIS
TU ELECTRIC COMPANY

HISTORICAL DATA

1991-1992 MONTH	ACTUAL DEMAND (KW)	ENERGY (KWH)	COST ($)	FCA ($)	PCRF ($)	EQUIV.FULL-LOAD HOURS (EFLH)	LOAD FACTOR (%)
JAN	76	17,040	$1,631.36	$0.0192	$0.000516	224	31%
FEB	75	14,560	$1,506.84	$0.0192	$0.000434	194	29%
MAR	64	12,160	$1,385.55	$0.0192	$0.000259	190	26%
APR	113	17,360	$1,643.35	$0.0192	$0.000290	154	21%
MAY	122	26,320	$2,114.32	$0.0192	$0.000421	216	30%
JUN	123	38,320	$2,437.76	$0.0192	$0.000366	312	43%
JLY	130	36,400	$2,461.09	$0.0192	$0.000327	280	39%
AUG	130	40,640	$2,572.09	$0.0192	$0.000331	313	43%
SEP	130	44,160	$2,671.59	$0.0192	$0.000500	340	47%
OCT	118	32,080	$2,219.66	$0.0192	$0.000156	272	38%
NOV	112	19,680	$1,752.47	$0.0192	$0.000397	176	24%
DEC	75	15,200	$1,538.65	$0.0192	$0.000437	203	28%
TOTAL/AVE	106	313,920	$23,934.73	$0.0192	$0.000370	239	33%

$0.0762 /KWH ave. $22.34 /MMBTU ave.

GAS COMPANY - BILLING ANALYSIS
LONE STAR GAS COMPANY

HISTORICAL DATA

1991-1992 MONTH	CONSUMPTION (MCF)	COST ($)	GCA ($)	MBTU/CF
JAN	215.1	$1,039.81	$0.0409	N/A
FEB	140.4	$674.21	($0.0442)	N/A
MAR	86.1	$449.05	$0.2726	N/A
APR	17.4	$95.69	($0.1185)	N/A
MAY	16.3	$98.69	$0.3979	N/A
JUN	12.5	$72.82	($0.0175)	N/A
JLY	12.7	$79.17	$0.4030	N/A
AUG	14.8	$90.43	$0.3914	N/A
SEP	13.0	$77.53	$0.1516	N/A
OCT	15.2	$87.85	$0.0786	N/A
NOV	207.6	$1,003.89	$0.0389	N/A
DEC	184.9	$869.97	($0.1044)	N/A
TOTAL/AVE	936.0	$4,639.11	$0.1242	N/A

$4.96 /MCF or MMBTU ave.

Attachment #1

Attachment #2a

HVAC OPERATING COST ANALYSIS

WALNUT HILL UNITED METHODIST

DALLAS

COOLING & HEATING
07-APR-92

LONE STAR GAS COMPANY
1133 S. MADISON
DALLAS, TEXAS 75208
(214) 573-4611

JAMES M. PHILLIPS, P.E., CEM
SALES ENGINEER

SUMMARY

SYSTEMS	AC RECIP.	ABSORPTION
COOLING SYSTEM SIZE (TONS)	150	150
ANNUAL FULL LOAD HOURS	1,008	1,008
ANNUAL TON-HOURS	151,200	151,200
HEATING SYSTEM SIZE (MBH)	1,193	1,193
ANNUAL FULL LOAD HOURS	383	383
HVAC OPERATION COST/TON/YR	$234.70	$130.93
HVAC COST/SQ.FT./YR	$1.04	$0.58
ANNUAL HVAC OPERATION COST =	$35,205	$19,640
ANNUAL SAVINGS USING GAS =		$15,565

THIS REPORT IS AN ESTIMATE OF THE OPERATION COST OF COOLING AND HEATING SYSTEMS. ACTUAL PERFORMANCE DEPENDS UPON WEATHER, EQUIPMENT CONTROLS, AND EQUIPMENT MAINTENANCE. NO WARRANTY, EITHER EXPRESSED OR IMPLIED, IS GIVEN WITH RESPECT TO THIS ANALYSIS. THE PROJECTED COSTS AND SAVINGS SHOWN ARE ESTIMATES AND ACTUAL COSTS MAY VARY.

Attachment #26

HVAC OPERATING COST ANALYSIS

WALNUT HILL UNITED METHODIST
DALLAS

COOLING & HEATING
07-APR-92

DATA INPUT PAGE

BUILDING DATA		UTILITY DATA	
SIZE:	34,000 SQ.FT.	GAS COMPANY:	LONE STAR GAS
		RATE:	DALLAS
COOLING LOAD:	1,797 MBH	WINTER or STEP 1:	$5.00 per MCF
HEATING LOAD:	1,193 MBH	SUMMER or STEP 2:	$4.00 per MCF
		STEP 3:	SUMMER CONTRACT
COOLING HOURS/JLY:	207 F.L.HOURS	AVERAGE GCA:	
HEATING HOURS/JAN:	100 F.L.HOURS		
		ELECTRIC COMPANY:	TU ELECTRIC
BASE HOURS/MONTH :	240 HOURS	RATE:	GS
BASE POWER-LIGHTS:	35 KW	FUEL COST ADJ.:	$0.0192 per KWH
-OTHERS:	0 KW	PCRF CHARGE:	$0.0005 per KWH
		CONTRACT KW:	KW
BASE GAS LOAD/MTH:	15 MCF		
		WATER COMPANY:	DALLAS
TAX RATE:	0 %	WATER RATE:	$2.15 per KGAL

GAS COOLING/HEATING EQUIPMENT DATA		ELECTRIC COOLING/HEATING EQUIPMENT DATA	
TYPE:	ABSORPTION	TYPE:	AC RECIP.
SIZE:	150 TONS	SIZE:	150 TONS
FUEL CONSUMPTION		POWER RATING:	1.23 KW/TON
COOLING:	1.80 MCFH	ELECTRIC POWER	
HEATING:	1.43 MCFH	COOLING:	185 KW
ELECT. CONTROLS:	3.6 KW	HEATING:	0 KW
CONDENSER WATER		GAS HEATING:	1.99 MCFH
FLOW:	630 GPM	CONDENSER WATER	
		FLOW:	0 GPM
AUXILARY POWER		AUXILARY POWER	
CONSTANT:	15 KW	CONSTANT:	15 KW
CYCLIC:	38 KW	CYCLIC:	25 KW
MAINTENANCE:	$0.01 /TON-HR	MAINTENANCE:	$0.02 /TON-HR

D/FW WEATHER DATA

COOLING & HEATING PRORATED HOURS:

	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
COOLING:	6%	1%	1%	13%	48%	80%	78%	90%	100%	55%	14%	1%
HEATING:	100%	63%	36%	2%	0%	0%	0%	0%	0%	1%	96%	85%

Attachment #2c

WALNUT HILL UNITED METHODIST
DALLAS

COOLING & HEATING
07-APR-92

GAS CHILLER/HEATER SYSTEM ANALYSIS PAGE
ENVIRONMENTALLY FRIENDLY [NO CFC/HCFC/HFC'S]

NON-HVAC BUILDING GAS COST: MONTHLY = $78 YEARLY = $936

MONTH	GAS CONSUMPTION COOLING (MCF)	GAS CONSUMPTION HEATING (MCF)	AUXILARY ELECTRIC CONSUMPTION (KWH)	AUXILARY ELECTRIC COST ($)	COOLING TOWER WATER CONSUMPTION (KGAL)	WATER & COST ($)	MAINTENANCE COST ($)	GAS COST ($)	TOTAL OPERATING COST ($)
JAN.	22.4	143.2	9,307	$628	3.5	$8	$19	$828	$1,482
FEB.	3.7	90.2	7,326	$576	0.6	$1	$3	$470	$1,049
MARCH	3.7	51.6	6,197	$546	0.6	$1	$3	$277	$827
APRIL	48.4	2.9	5,814	$536	7.6	$16	$40	$257	$849
MAY	178.8	0.0	7,260	$574	28.2	$61	$149	$715	$1,499
JUNE	298.1	0.0	10,031	$647	46.9	$101	$248	$1,192	$2,188
JULY	290.6	0.0	9,857	$642	45.8	$98	$242	$1,162	$2,145
AUG.	335.3	0.0	10,896	$669	52.8	$114	$279	$1,341	$2,404
SEPT.	372.6	0.0	11,762	$692	58.7	$126	$311	$1,490	$2,619
OCT.	204.9	1.4	9,408	$630	32.3	$69	$171	$825	$1,596
NOV.	52.2	137.5	9,832	$641	8.2	$18	$43	$949	$1,651
DEC.	3.7	121.7	8,246	$600	0.6	$1	$3	$627	$1,231
YEARLY	1,814.4	548.5	105,937	$7,381	286	$614	$1,512	$10,133	$19,640

ANNUAL TAXES ON THE UTILITIES WILL BE: $0

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YOUR ANNUAL COOLING/HEATING COST WILL BE APPROXIMATELY: $19,640
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Attachment #2d

WALNUT HILL UNITED METHODIST
DALLAS

COOLING & HEATING
07-APR-92

ELECTRIC A/C & HEATING SYSTEM ANALYSIS PAGE
FREON BASED CFC/HCFC/HFC SYSTEMS - FREON COST NOT INCLUDED IN THIS ANALYSIS

NON-HVAC BUILDING ELECTRIC COST: MONTHLY = $664 YEARLY = $7,967

MONTH	POWER CONSUMPTION		ENERGY CONSUMPTION				C.T. WATER	MAINT.	ELECTRIC COSTS		GAS	TOTAL
	COOLING (KW)	HEATING (KW)	COOLING (KWH)	HEATING (KWH) or (MCF)		AUXILARY (KWH)	USAGE & $ (KGAL)	COST ($)	DEMAND ($)	ENERGY ($)	COST ($)	OPERATING COST ($)
JAN.	62	0	2,298	0	198.9	7,449	0.0	$37	$1,178	$484	$995	$2,694
FEB.	62	0	383	0	125.3	6,251	0.0	$6	$1,178	$330	$627	$2,141
MARCH	46	0	383	0	71.6	5,568	0.0	$6	$1,178	$296	$358	$1,838
APRIL	142	0	4,978	0	4.0	5,336	0.0	$81	$1,242	$513	$20	$1,856
MAY	185	0	18,382	0	0.0	5,619	0.0	$298	$1,178	$1,193	$0	$2,669
JUNE	185	0	30,636	0	0.0	7,295	0.0	$497	$1,178	$1,686	$0	$3,361
JULY	185	0	29,870	0	0.0	7,190	0.0	$484	$1,532	$1,842	$0	$3,858
AUG.	185	0	34,466	0	0.0	7,818	0.0	$559	$1,532	$2,008	$0	$4,099
SEPT.	185	0	38,295	0	0.0	8,342	0.0	$621	$1,532	$2,122	$0	$4,275
OCT.	154	0	21,062	0	2.0	7,511	0.0	$342	$1,322	$1,420	$8	$3,092
NOV.	142	0	5,361	0	190.9	7,767	0.0	$87	$1,242	$652	$955	$2,935
DEC.	62	0	383	0	169.1	6,808	0.0	$6	$1,178	$357	$846	$2,387
YEARLY	N/C	N/C	186,497	0	761.8	82,955	0 @ $0	$3,024	$15,470	$12,903	$3,807	$35,205

ANNUAL TAXES ON THE UTILITIES WILL BE: $0

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YOUR ANNUAL COOLING/HEATING COST WILL BE APPROXIMATELY: $35,205
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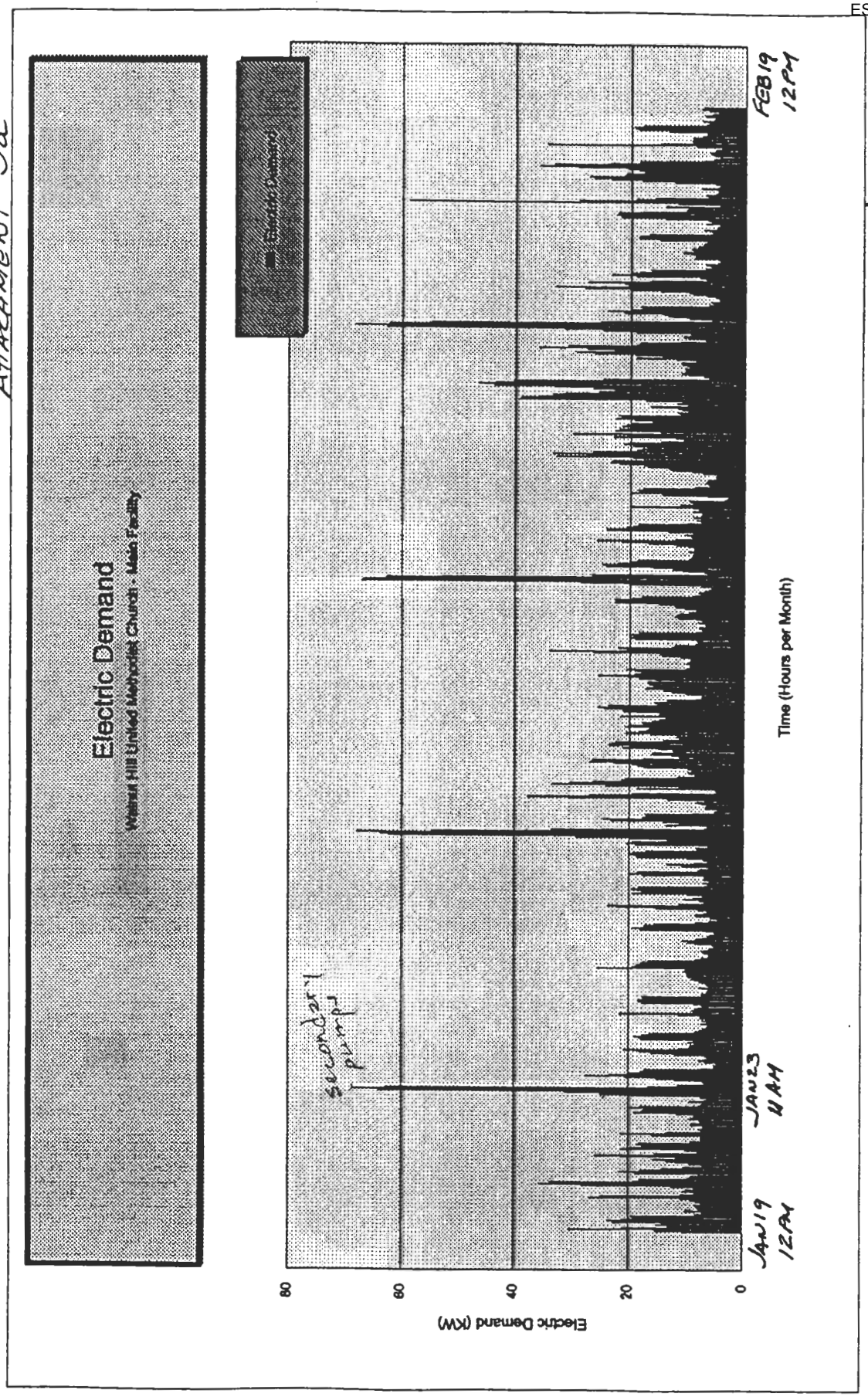
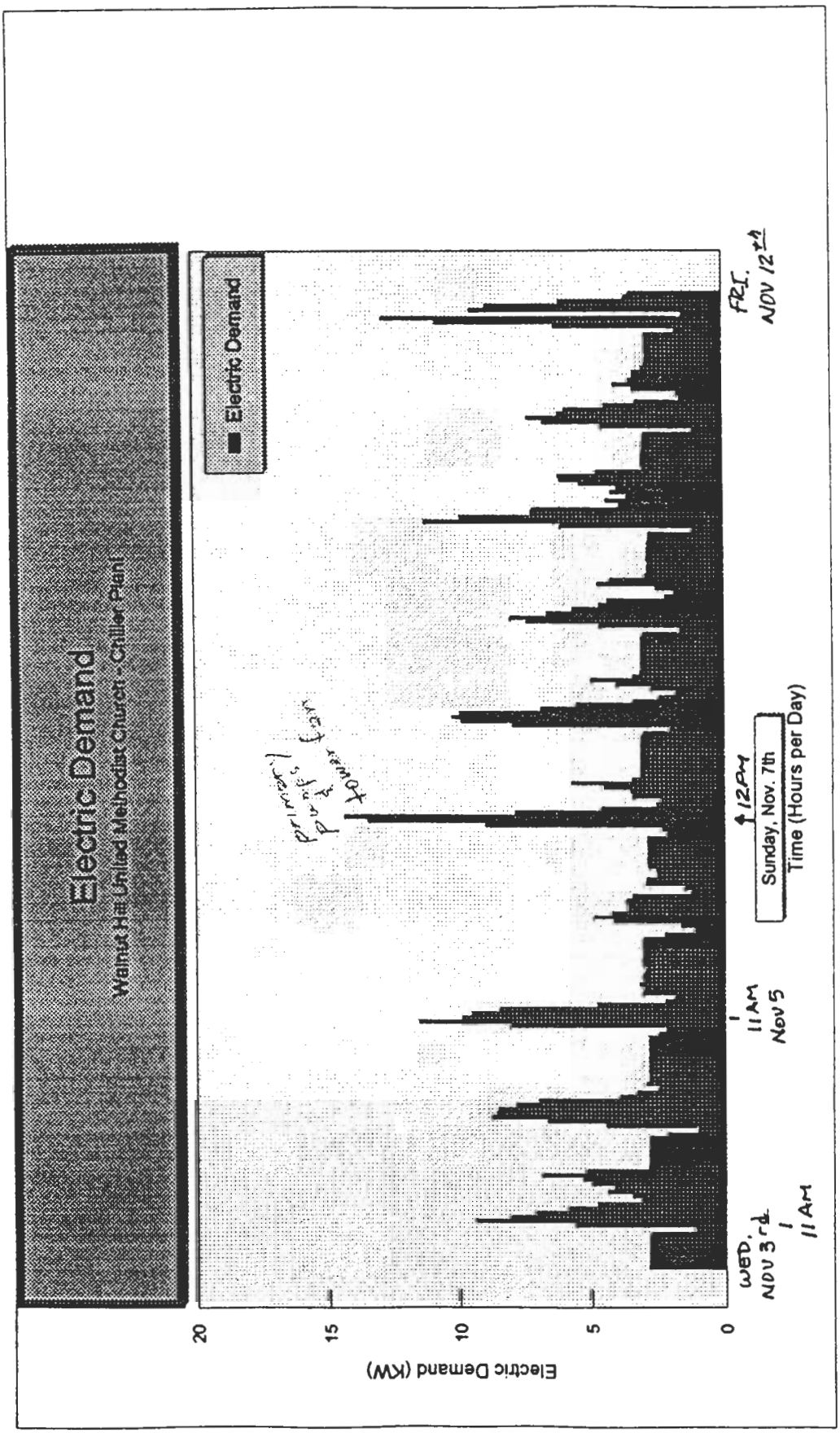
+----------+
| AVERAGE BUILDING BASE COST PER KWH = $0.0738 |
| AVERAGE ELECTRIC HVAC COST PER KWH = $0.1053 |
+----------+



ATTACHMENT #3a

Each spike is a Sunday from 10:AM to 1:00 PM

Wednesday 9PM FEB 16


Electric Demand
Walnut Hill United Methodist Church - Chiller Plant
Electric Demand
Electric Demand (KW)
20
15
10
5
0
WED. NOV 3rd 11 AM
11 AM Nov 5
12 PM
Sunday, Nov. 7th
Time (Hours per Day)
FRI. NOV 12th

UTILITY BILL ANALYSIS

Walnut Hill United Methodist Church Dallas Jim Phillips, LSG	DATE: 01/15/98 REPORT BY: JIM PHILLIPS, P.E., CEM, CPE

Billing Analysis - Electric Company
TU Electric

1996-1997 Month	Actual Demand (KW)	Energy (KWH)	Cost ($)	FCA ($/KWH)	Cogen. PCRF ($/KWH)	Equiv. F.L. Hours	Load Factor (%)
January	93	15,808	$1,588.48	$0.018926	n/a	170.0	23.6%
February	94	16,224	$1,609.70	$0.018926	n/a	172.6	25.7%
March	88	13,456	$1,443.41	$0.018926	n/a	152.9	21.2%
April	90	15,616	$1,570.20	$0.018926	n/a	173.5	24.1%
May	92	16,400	$1,617.98	$0.018926	n/a	178.3	24.8%
June	95	22,576	$1,863.53	$0.018926	n/a	237.6	33.0%
July	110	26,688	$2,021.48	$0.018926	n/a	242.6	33.7%
August	105	24,400	$2,012.48	$0.018926	n/a	232.4	32.3%
September	109	25,744	$2,060.26	$0.018926	n/a	236.2	32.8%
October	99	20,448	$1,883.89	$0.018926	n/a	206.5	28.7%
November	85	15,360	$1,514.96	$0.018926	n/a	180.7	25.1%
December	75	14,384	$1,406.14	$0.018926	n/a	191.8	26.6%
	110	227,104	$20,592.51	$0.01893	n/a	2,375	27.6%
	Max.	Total	Total	Ave.	Ave.	Total	Ave.

Average $0.0907 /KWH = $26.57 /Mmbtu

Billing Analysis - Gas Company
Lone Star Gas

Year Month	Consumption (MCF)	Cost ($)	GCA ($/MCF)	Btu/CF
Jan.	217	$874.58	n/a	1,000
Feb.	177	$724.58	n/a	1,000
Mar.	130	$548.33	n/a	1,000
Apr.	109	$469.58	n/a	1,000
May	115	$492.08	n/a	1,000
June	124	$525.83	n/a	1,000
July	313	$1,234.58	n/a	1,000
Aug.	281	$1,114.58	n/a	1,000
Sept.	239	$957.08	n/a	1,000
Oct.	126	$533.33	n/a	1,000
Nov.	100	$435.83	n/a	1,000
Dec.	180	$735.83	n/a	1,000
	2,111	$8,646.21	n/a	1,000
	Total	Total	Ave.	Ave.

Average $4.10 /MCF or Mmbtu

ATTACHMENT #4

HVAC OPERATION COST ANALYSIS

For

Walnut Hill United Methodist Church

DALLAS, TEXAS

ANALYZED BY:
LONE STAR GAS COMPANY
Jim Phillips, P.E.
CEM, CPE, CDSM

DATE : 15-Jan-98

ATTACHMENT 5a

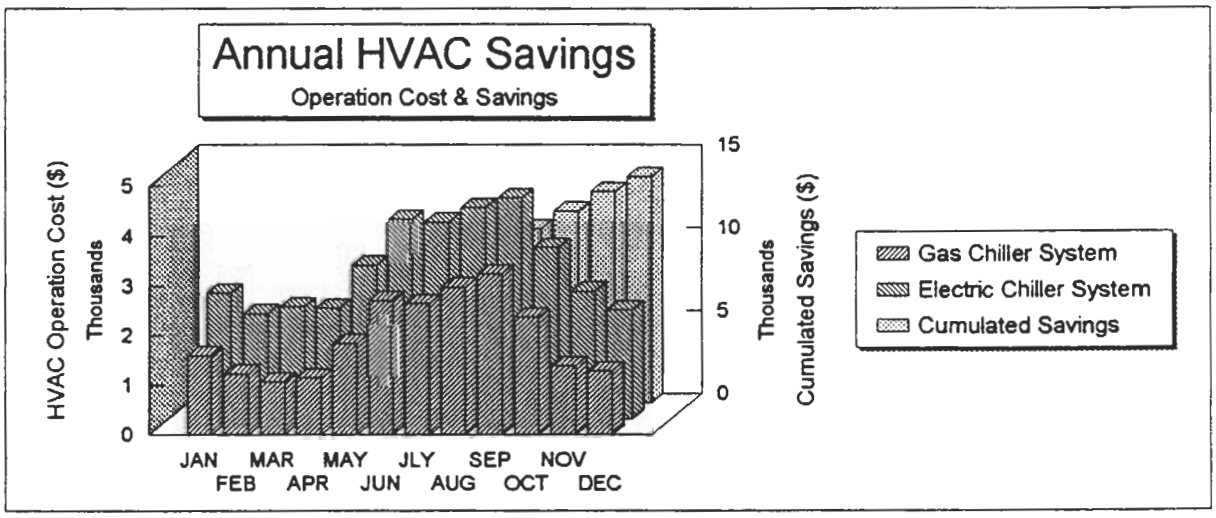
SUMMARY OF CHILLER ANALYSIS

FOR

Walnut Hill United Methodist

SYSTEM	ELECTRIC	GAS
COOLING		
TONNAGE	150	150
TON-HOURS	151,214	151,214
OPERATION COST	**$32,142**	**$17,566**
COST per SQ.FT.	$0.62	$0.34
HEATING		
HEATING LOAD (Mbh)	1,185	1,185
HEATING F.L. HOURS	381	381
OPERATION COST	**$4,963**	**$5,902**
COST per SQ.FT.	$0.10	$0.11
TOTAL HVAC OPERATION COST	**$37,105**	**$23,468**
BUILDING NON-HVAC GAS COST	$930	$930
BLDG. NON-HVAC ELECTRIC COST	$8,156	$8,156
TOTAL BLDG. GAS & ELECT. COST	**$46,191**	**$32,555**

ANNUAL SAVINGS USING GAS EQUIPMENT **$13,637**



This report is an estimate of the operation cost of cooling and heating systems. Actual performance depends upon weather and equipment control and maintenance. No warranty, either expressed or implied, is given with respect to this analysis. The projected costs and savings are estimates and actual costs may vary.

RETURN ON INVESTMENT ANALYSIS

GAS CHILLER COST		$104,000
INSTALLATION COST		$75,000
	TOTAL	$179,000

ELECTRIC CHILLER COST		$50,000
INSTALLATION COST		$60,000
	TOTAL	$110,000

NET INCREMENTAL COST OF GAS CHILLER SYSTEM.....	$69,000
CASH INCENTIVE.....	$27,000
ANNUAL SAVINGS USING GAS CHILLER SYSTEM.....	$13,637

SIMPLE 100% PAY BACK TERM (YEARS)	3.1 YEARS
RETURN ON INVESTMENT (FIRST YEAR)	32% PERCENT

BUILDING DATA

BLDG. TYPE: OFFICE
SIZE: 51,500 SQ. FT.

WEEKDAY OPERATION:	7.3 HRS/DAY or	160 HRS/MONTH
WEEKEND OPERATION:	10.0 HRS/DAY or	80 HRS/MONTH
		240 TOTAL HRS/MTH

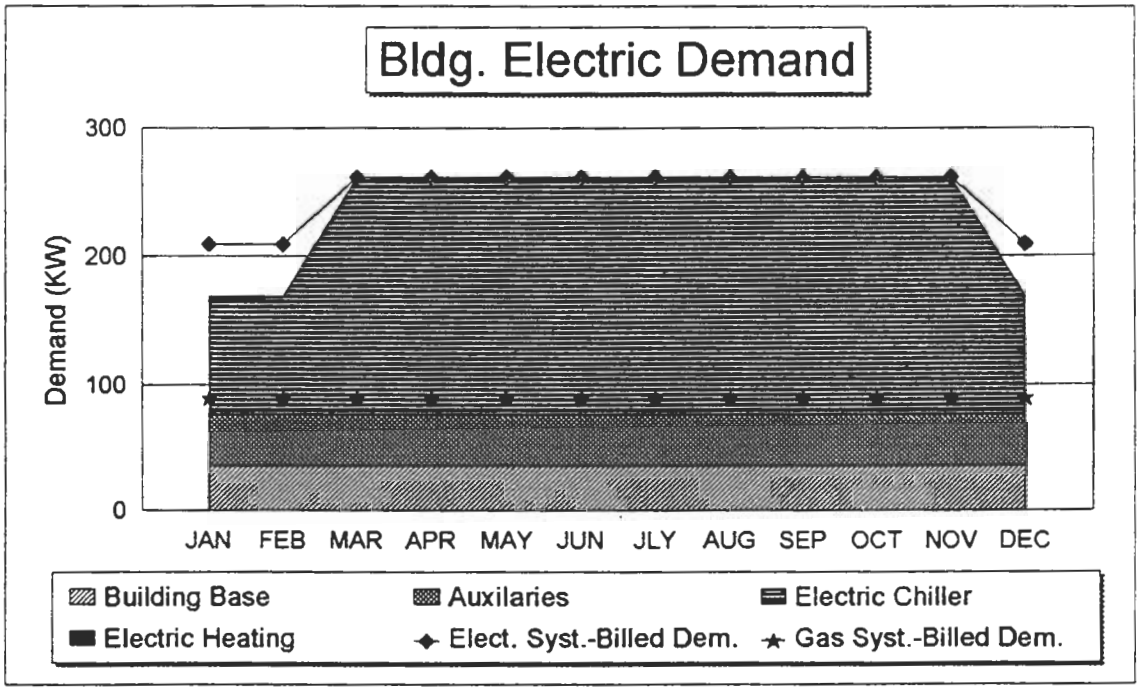
MAX. COOLING HOURS for JULY:	207 FULL LOAD HOURS/MTH
MAX. HEATING HOURS for JAN.:	100 FULL LOAD HOURS/MTH

DESIGN COOLING LOAD:	1,803 MBH =	150 TONS
ANALYZED COOLING LOAD:	1,803 MBH =	150 TONS

DESIGN HEATING LOAD:	1,185 MBH
ANALYZED HEATING LOAD:	1,185 MBH

BASE POWER - LIGHTS:	35 KW	BASE GAS LOAD:	15 MCF/MTH
OTHERS:	0 KW		

TAX RATE:	0 %	WEATHER AREA:	D/FW



UTILITY RATES

GAS COMPANY:	**LONE STAR GAS**		**ELECTRIC COMPANY:**	**TU ELECTRIC**	
RATE:	**COMMERCIAL**		**RATE:**	**GS-1992**	
CUSTOMER CHARGE:	$10.00		CONTRACT KW:		KW
WINTER or STEP 1:	$5.00	per MCF	BILLED CONTRACT:	$1.00	/KW excess
SUMMER or STEP 2:	$4.00	per MCF	CUSTOMER CHARGE:	$15.00	
		per MCF	BILLED DEMAND:	$6.74	/KW
AVERAGE GCA:		per MCF	MAX. of:	100%	ACTUAL *
				80%	ON-PEAK
ITCC CONTRACT:	NO			50%	ANNUAL PEAK
				50%	CONTRACT
			ENERGY CHARGES:		
			STEP 1:	$0.0572	/KWH
			STEP 2:	$0.0300	/KWH
			STEP 3:	$0.0066	/KWH
WATER RATES for:			**EXTENDER:	170	KWH x (KW-10)
DALLAS, TEXAS			FUEL COST ADJUSTMENT:	$0.019200	/KWH
WATER/SEWER RATE:	$2.15	per KGAL	PCRF CHARGE:	$0.001000	/KWH

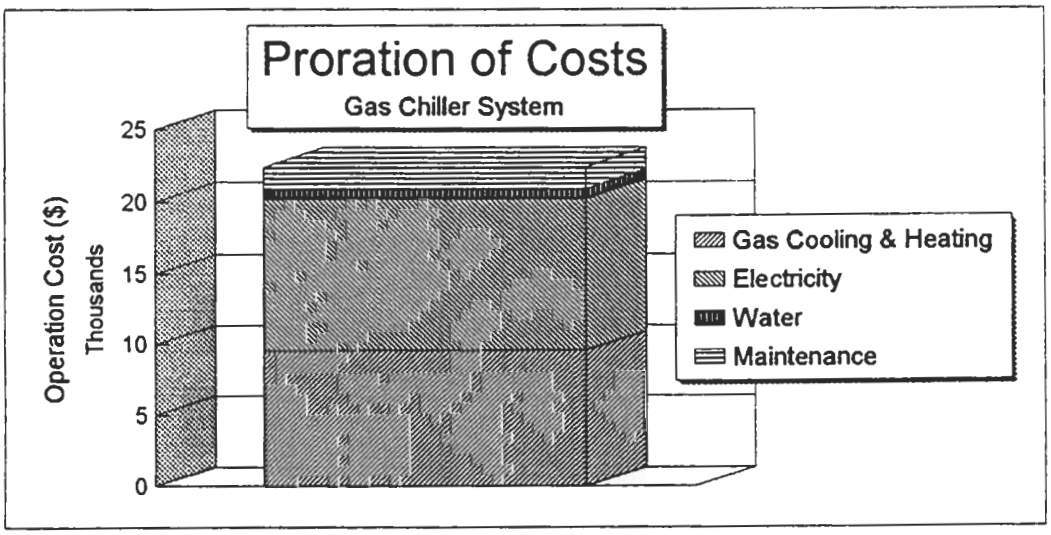
* Min. of "actual" KW or "on-peak" KW + 25% of excess KW over "on-peak" KW. ** Applies to STEP 2.

GAS CHILLER SYSTEM DATA

TYPE:	ABSORPTION
MAKE:	Yazaki
SIZE:	150 TONS
NUMBER of UNITS:	2

GAS FUEL CONSUMPTION

COOLING:	1.80 MCFH, input
COOLING EFFICIENCY:	1.00 COP
HEATING:	1.43 MCFH, input
HEATING EFFICIENCY:	83 %
ELECTRIC HEATING:	0 KW
EFFICIENCY:	100 %
CONDENSER WATER FLOW:	660 GPM
CHILLER ELECTRIC POWER	3.5 KW
MAINTENANCE:	$0.01 /TON-HR



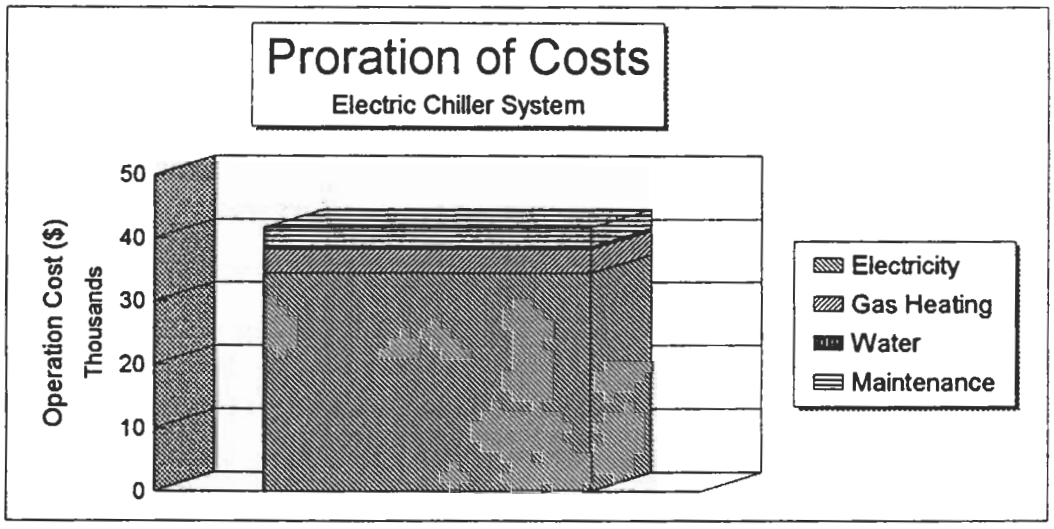
ELECTRIC CHILLER SYSTEM DATA

TYPE:	RECIPROCATING
AIR	COOLED
R-12	REFRIGERANT
EXISTING	SYSTEM
3	NUMBER of UNITS

CHILLER SIZE:	150	TONS
POWER RATING:	1.23	KW/TON
CHILLER POWER:	185	KW
EER:	9.8	

ELECTRIC HEATING:	GAS	
POWER RATING:	0	KW
EFFICIENCY:	0	%
GAS HEATING:	1.97	MCFH,input
EFFICIENCY:	60	%

CONDENSER WATER FLOW:	450	GPM
MAINTENANCE:	$0.02	/TON-HR



AUXILIARY EQUIPMENT DATA

	GAS	ELECTRIC		SIZE
CHILLED WATER PUMP - AUXILARY:	8.4	8.4	KW	
CHILLED WATER PUMP - CYCLIC:	0.0	0.0	KW	
CONDENSER WATER PUMP - CONSTANT:	0.0	0.0	KW	
CONDENSER WATER PUMP - CYCLIC:	11.9	7.9	KW	
TOWER/CONDENSER FAN - CYCLIC:	13.1	7.9	KW	
A/H UNITS - AUXILARY:	17.2	17.2	KW	
A/H UNITS - CYCLIC:	0.0	0.0	KW	
HOT WATER PUMP - AUXILARY	3.4	3.4	KW	
HOT WATER PUMP - CYCLIC:	0.0	0.0	KW	
OTHER EQUIPMENT - CONSTANT:	0.0	0.0	KW	name
OTHER EQUIPMENT - CYCLIC:	0.0	0.0	KW	name
TOTAL:	54.0	44.9		

200 **AUX. HOURS of OPERATION / MONTH**

NOTE: AUXILARY uses Aux. Hours
CYCLIC uses Cooling or Heating Hours
CONSTANT uses Building Hours

PRORATED OPERATING HOURS

WEATHER AREA: D/FW

FULL LOAD MONTHLY OPERATION HOURS

207 Cooling 100 Heating 240.16 Building 200 Auxilary

MONTH	COOLING		HEATING	BLDG.	AUXILIARIES				
	BASE	PEAKING		OPER.	CHW PUMP	CW PUMP	TOWER/ COND.FAN	A/H UNITS	HOT WATER PUMP
JAN	0%	6%	100%	100%	6%	6%	6%	100%	100%
FEB.	0%	1%	73%	100%	1%	1%	1%	100%	73%
MAR	0%	1%	52%	100%	1%	1%	1%	100%	52%
APRIL	0%	13%	15%	100%	14%	13%	13%	100%	15%
MAY	0%	48%	0%	100%	50%	48%	48%	100%	0%
JUNE	0%	80%	0%	100%	84%	80%	80%	100%	0%
JULY	0%	78%	0%	100%	82%	78%	78%	100%	0%
AUG.	0%	90%	0%	100%	95%	90%	90%	100%	0%
SEPT.	0%	100%	0%	100%	105%	100%	100%	100%	0%
OCT.	0%	55%	15%	100%	58%	55%	55%	100%	15%
NOV.	0%	14%	46%	100%	15%	14%	14%	100%	46%
DEC	0%	1%	80%	100%	1%	1%	1%	100%	80%

Notes: The sum of the Cooling Base + Peak percentages (%) should not exceed 100%.
Cooling = Chiller (KW or MCFH) x Cooling F.L. Hours x (%Base+%Peaking).
Heating = System (KW or MCFH) x Heating F.L. Hours x %Heating.
Building = Building Electric KW x Building F.L. Hours x %Bldg. Operation Hours.
Auxilary = Auxilary Electric KW x Each Pump or Fan x %Appropriate Pump or Fan Hours.

BUILDING NON-HVAC ELECTRIC & GAS COST ANALYSIS

BUILDING ELECTRIC COST

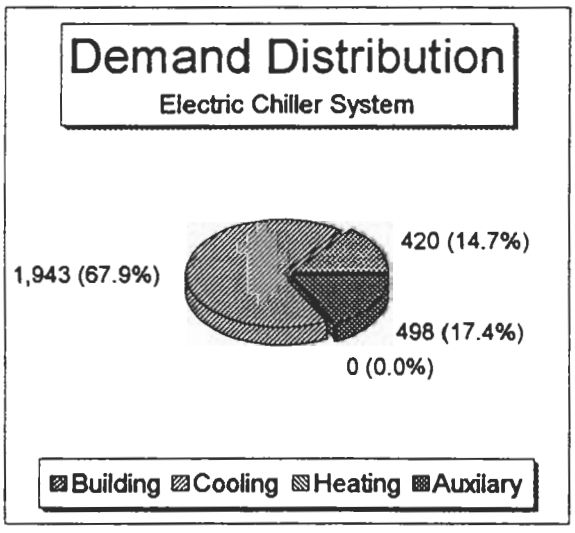
MONTH	DEMAND COST	ENERGY COST	TOTAL COST
JAN	$225	$518	$743
FEB.	$225	$475	$700
MAR	$225	$518	$743
APR	$225	$504	$729
MAY	$225	$518	$743
JUN.	$225	$504	$729
JULY	$225	$518	$743
AUG.	$225	$518	$743
SEPT.	$225	$504	$729
OCT.	$225	$518	$743
NOV.	$225	$504	$729
DEC	$225	$518	$743
TAX	$0	$0	$0
TOTAL	$2,705	$6,114	$8,819

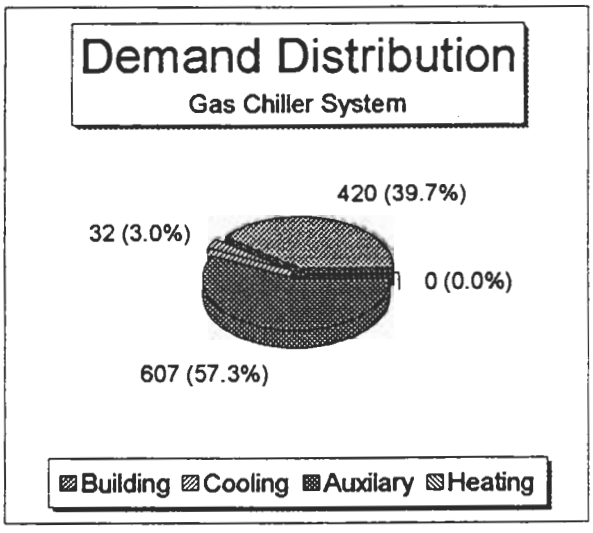
Lights, computers, clocks, machinery, etc.

BUILDING GAS COST

MONTH	COST
JAN	$85
FEB.	$85
MAR	$85
APR	$85
MAY	$70
JUN.	$70
JULY	$70
AUG.	$70
SEPT.	$70
OCT.	$70
NOV.	$85
DEC	$85
TAX	$0
TOTAL	$930

Domestic hot water





2,860 KW = Total Annual Demand = 1,070 KW

OPERATION COST of the GAS CHILLER/HEATER SYSTEM

COOLING

ENVIRONMENTALLY FRIENDLY - NO CFC/HCFC/HFC's

	GAS CONSUMPTION		ELECTRIC AUXILIARY EQUIPMENT			COOLING TOWER		MAINT.	OPERATION
	COOLING (MCF)	COST ($)	DEMAND (KW)	ENERGY (KWH)	COST ($)	USAGE (GAL)	COST ($)	COST ($)	TOTAL COST ($)
JAN	22.4	$112	6.9	615	$161	4,058	$9	$19	$300
FEB.	3.7	$19	1.7	139	$131	676	$1	$3	$154
MAR	3.7	$19	2.4	185	$125	676	$1	$3	$149
APRIL	48.5	$243	35.1	3,085	$566	8,791	$19	$40	$868
MAY	179.1	$895	50.6	6,772	$722	32,461	$70	$149	$1,837
JUNE	298.5	$1,492	50.6	8,991	$845	54,102	$116	$248	$2,703
JULY	291.0	$1,455	50.6	8,852	$838	52,749	$113	$242	$2,648
AUG.	335.8	$1,679	50.6	9,684	$884	60,864	$131	$279	$2,973
SEPT.	373.1	$1,866	50.6	10,378	$921	67,627	$145	$311	$3,242
OCT.	205.2	$1,026	45.8	6,664	$741	37,195	$80	$171	$2,018
NOV.	52.2	$261	22.4	2,094	$193	9,468	$20	$43	$518
DEC	3.7	$19	1.6	128	$133	676	$1	$3	$156
TAX		$0			$0		$0	$0	$0
TOTAL	1,817.1	$9,085	50.6	57,589	$6,261	329,343	$708	$1,512	$17,566

HEATING

MONTH	GAS CONSUMPTION		ELECTRIC HEATING		AUXILIARIES		ELECTRIC	MAINT.	OPERATION
	HEATING (MCF)	COST ($)	DEMAND KW	ENERGY KWH	DEMAND (KW)	ENERGY (KWH)	COST ($)	COST ($)	TOTAL COST ($)
JAN	142.7	$714	0	353	44	3,923	$574	$0	$1,288
FEB.	104.2	$521	0	257	49	3,870	$552	$0	$1,073
MAR	74.2	$371	0	183	48	3,681	$541	$0	$912
APRIL	21.4	$107	0	53	15	1,362	$166	$0	$273
MAY	0.0	$0	0	0	0	0	$0	$0	$0
JUNE	0.0	$0	0	0	0	0	$0	$0	$0
JULY	0.0	$0	0	0	0	0	$0	$0	$0
AUG.	0.0	$0	0	0	0	0	$0	$0	$0
SEPT.	0.0	$0	0	0	0	0	$0	$0	$0
OCT.	21.4	$107	0	53	5	695	$249	$0	$356
NOV.	65.6	$328	0	162	28	2,632	$546	$0	$874
DEC	114.2	$571	0	282	49	3,927	$556	$0	$1,127
TAX		$0					$0	$0	$0
TOTAL	544	$2,719	0	1,343	238	20,090	$3,184	$0	$5,902

ANNUAL COOLING & HEATING

GAS		ELECTRIC			WATER		MAINT.	TOTAL
USAGE (MCF)	COST ($)	DEMAND PEAK (KW)	ENERGY (KWH)	COST ($)	USAGE (GAL)	COST ($)	COST ($)	COST ($)
2,361	$11,804	54	79,022	$9,444	329,343	$708	$1,512	$23,468

ELECTRIC DEMAND and ENERGY ANALYSIS
GAS CHILLER/HEATING SYSTEM

DEMAND (KW)

89 KW "ON-PEAK"	89 KW "ANNUAL PEAK"	0 KW "CONTRACT"
71 KW 80% "ON-PEAK"	45 KW 50% "ANNUAL PEAK"	0 KW 50% "Contract"

MTH	BILLING		BUILDING		CHILLER		HEATING		AUXILIARY	
	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW
JAN	89	89	35	35	4	4	4	0	51	51
FEB.	89	89	35	35	4	4	4	0	51	51
MAR	89	89	35	35	4	4	3	0	51	51
APR	89	89	35	35	4	4	2	0	51	51
MAY	89	89	35	35	4	4	0	0	51	51
JUN.	89	89	35	35	4	4	0	0	51	51
JULY	89	89	35	35	4	4	0	0	51	51
AUG.	89	89	35	35	4	4	0	0	51	51
SEPT.	89	89	35	35	4	4	0	0	51	51
OCT.	89	89	35	35	4	4	2	0	51	51
NOV.	89	89	35	35	4	4	3	0	51	51
DEC	89	89	35	35	4	4	4	0	51	51
MAX	**89**	**89**	**35**	**35**	**4**	**4**	**4**	**0**	**51**	**51**

ENERGY (KWH)

MTH	BILLED	BUILDING				COOLING & HEATING				
	TOT.KWH	BLD.KWH	STEP 1	STEP 2	STEP 3	CL. KWH	HT. KWH	AUX.KWH	STEP 2	STEP 3
JAN	13,625	8,691	2,500	6,191	0	44	353	4,538	4,934	0
FEB.	12,123	7,850	2,500	5,350	0	7	257	4,008	4,273	0
MAR	12,747	8,691	2,500	6,191	0	7	183	3,866	4,056	0
APR	13,005	8,410	2,500	5,910	0	95	53	4,447	4,595	0
MAY	15,813	8,691	2,500	6,191	0	350	0	6,772	7,122	0
JUNE	17,985	8,410	2,500	5,910	0	584	0	8,991	9,575	0
JULY	18,112	8,691	2,500	6,191	0	569	0	8,852	9,422	0
AUG.	19,032	8,691	2,500	6,191	0	657	0	9,684	10,341	0
SEPT.	19,518	8,410	2,500	5,910	0	730	0	10,378	11,043	64
OCT.	16,504	8,691	2,500	6,191	0	401	53	7,359	7,814	0
NOV.	13,401	8,410	2,500	5,910	0	102	162	4,727	4,991	0
DEC	13,036	8,691	2,500	6,191	0	7	282	4,056	4,345	0
Total	**184,902**	**102,327**	**30,000**	**72,327**	**0**	**3,554**	**1,343**	**77,679**	**82,511**	**64**

OPERATION COST of the ELECTRIC CHILLER & HEATING SYSTEM

COOLING

REQUIRES CFC/HCFC/HFC REFRIGERANTS -- COSTS NOT INCLUDED

MONTH	CHILLER COST		AUXILIARY EQUIPMENT		EXCESS	COOLING TOWER		MAINT.	TOTAL
	DEMAND COST	ENERGY COST	DEMAND COST	ENERGY COST	CONTRACT COST	USAGE (GAL)	COST ($)	COST ($)	OPERATION COST
JAN	$894	$115	$279	$9	$0	2,767	$6	$37	$1,341
FEB.	$894	$19	$279	$2	$0	461	$1	$6	$1,202
MAR	$1,247	$19	$279	$2	$0	461	$1	$6	$1,555
APRIL	$1,247	$250	$279	$77	$0	5,994	$13	$81	$1,947
MAY	$1,247	$923	$279	$294	$0	22,132	$48	$298	$3,089
JUNE	$1,247	$1,538	$279	$375	$0	36,887	$79	$497	$4,016
JULY	$1,247	$1,499	$279	$370	$0	35,965	$77	$484	$3,958
AUG.	$1,247	$1,730	$279	$345	$0	41,498	$89	$559	$4,249
SEPT.	$1,247	$1,922	$279	$275	$0	46,109	$99	$621	$4,444
OCT.	$1,247	$1,057	$279	$225	$0	25,360	$55	$342	$3,205
NOV.	$1,247	$269	$279	$38	$0	6,455	$14	$87	$1,934
DEC	$894	$19	$279	$2	$0	461	$1	$6	$1,202
TAX	$0	$0	$0	$0	$0		$0	$0	$0
TOTAL	$13,905	$9,362	$3,353	$2,014	$0	224,552	$483	$3,024	$32,142

HEATING

MONTH	GAS HEATING		ELECTRIC HEATING		AUXIL. EQUIPMENT		TOTAL	MAINT.	TOTAL
	USAGE (MCF)	COST ($)	DEMAND COST	ENERGY COST	DEMAND COST	ENERGY COST	ELECTRIC COST	COST ($)	OPERATION COST
JAN	197	$983	$0	$0	$0	$214	$214	$0	$1,197
FEB.	144	$718	$0	$0	$0	$198	$198	$0	$916
MAR	102	$511	$0	$0	$0	$191	$191	$0	$702
APRIL	30	$148	$0	$0	$0	$134	$134	$0	$281
MAY	0	$0	$0	$0	$0	$0	$0	$0	$0
JUNE	0	$0	$0	$0	$0	$0	$0	$0	$0
JULY	0	$0	$0	$0	$0	$0	$0	$0	$0
AUG.	0	$0	$0	$0	$0	$0	$0	$0	$0
SEPT.	0	$0	$0	$0	$0	$0	$0	$0	$0
OCT.	30	$148	$0	$0	$0	$92	$92	$0	$240
NOV.	90	$452	$0	$0	$0	$186	$186	$0	$639
DEC	157	$787	$0	$0	$0	$201	$201	$0	$988
TAX		$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	749	$3,747	$0	$0	$0	$1,216	$1,216	$0	$4,963

ANNUAL COOLING & HEATING

GAS		WATER		ELECTRIC			MAINT.	TOTAL
USAGE (MCF)	COST ($)	USAGE (GAL)	COST ($)	ENERGY (KWH)	DEMAND PK. (KW)	COST ($)	COST ($)	COST ($)
749	$3,747	224,552	$483	254,967	226	$29,851	$3,024	$37,105

ELECTRIC DEMAND and ENERGY ANALYSIS
ELECTRIC CHILLER & HEATING SYSTEM

DEMAND (KW)

261 KW "ON-PEAK"	261 KW "ANNUAL PEAK"	0 KW "CONTRACT"
209 KW 80% "ON-PEAK"	131 KW 50% "ANNUAL PEAK"	0 KW 50% "Contract"

MTH	BILLING		BUILDING		CHILLER		HEATING		AUXILIARY	
	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW	ACT. KW	BILL. KW
JAN	169	209	35	35	93	133	0	0	41	41
FEB.	169	209	35	35	93	133	0	0	41	41
MAR	261	261	35	35	185	185	0	0	41	41
APR	261	261	35	35	185	185	0	0	41	41
MAY	261	261	35	35	185	185	0	0	41	41
JUN.	261	261	35	35	185	185	0	0	41	41
JULY	261	261	35	35	185	185	0	0	41	41
AUG.	261	261	35	35	185	185	0	0	41	41
SEPT.	261	261	35	35	185	185	0	0	41	41
OCT.	261	261	35	35	185	185	0	0	41	41
NOV.	261	261	35	35	185	185	0	0	41	41
DEC	169	209	35	35	93	133	0	0	41	41
MAX	**261**	**261**	**35**	**35**	**185**	**185**	**0**	**0**	**41**	**41**

ENERGY (KWH)

MTH	BILLED	BUILDING				COOLING & HEATING				
	TOTAL KWH	BLD. KWH	STEP 1	STEP 2	STEP 3	CL. KWH	HT. KWH	AUX. KWH	STEP 2	STEP 3
JAN	15,413	8,691	2,500	6,191	0	2,298	0	4,425	6,722	0
FEB.	12,222	7,850	2,500	5,350	0	383	0	3,989	4,372	0
MAR	12,921	8,691	2,500	6,191	0	383	0	3,847	4,230	0
APR	17,590	8,410	2,500	5,910	0	4,978	0	4,201	9,180	0
MAY	32,937	8,691	2,500	6,191	0	18,382	0	5,865	24,246	0
JUN.	46,525	8,410	2,500	5,910	0	30,636	0	7,478	38,114	0
JULY	45,938	8,691	2,500	6,191	0	29,870	0	7,377	37,248	0
AUG.	51,139	8,691	2,500	6,191	0	34,466	0	7,983	40,061	2,387
SEPT.	55,192	8,410	2,500	5,910	0	38,295	0	8,487	40,341	6,441
OCT.	36,072	8,691	2,500	6,191	0	21,062	0	6,319	27,382	0
NOV.	18,234	8,410	2,500	5,910	0	5,361	0	4,462	9,823	0
DEC	13,111	8,691	2,500	6,191	0	383	0	4,037	4,420	0
TOTAL	**357,293**	**102,327**	**30,000**	**72,327**	**0**	**186,497**	**0**	**68,470**	**246,139**	**8,828**

OPERATION COST of the GAS CHILLER/HEATER SYSTEM

COOLING

ENVIRONMENTALLY FRIENDLY - NO CFC/HCFC/HFC's

	GAS CONSUMPTION		ELECTRIC AUXILIARY EQUIPMENT			COOLING TOWER		MAINT.	OPERATION
	COOLING (MCF)	COST ($)	DEMAND (KW)	ENERGY (KWH)	COST ($)	USAGE (GAL)	COST ($)	COST ($)	TOTAL COST ($)
JAN	3.2	$12	0.7	61	$152	572	$1	$3	$168
FEB.	3.2	$12	0.9	72	$145	572	$1	$3	$161
MAR	3.2	$12	1.2	95	$137	572	$1	$3	$153
APRIL	75.7	$284	35.5	3,524	$611	13,721	$30	$63	$988
MAY	116.7	$438	50.6	5,714	$702	21,154	$45	$97	$1,283
JUNE	126.2	$473	50.6	5,898	$738	22,869	$49	$105	$1,365
JULY	312.3	$1,171	50.6	9,517	$950	56,601	$122	$260	$2,503
AUG.	280.7	$1,053	50.6	8,904	$939	50,884	$109	$234	$2,335
SEPT.	239.7	$899	50.6	8,106	$894	43,451	$93	$200	$2,086
OCT.	94.6	$355	37.8	4,022	$717	17,152	$37	$79	$1,187
NOV.	3.2	$12	1.6	118	$132	572	$1	$3	$148
DEC	3.2	$12	0.9	71	$146	572	$1	$3	$161
TAX		$0			$0		$0	$0	$0
TOTAL	1,261.8	$4,732	50.6	46,102	$6,264	228,690	$492	$1,050	$12,537

HEATING

MONTH	GAS CONSUMPTION		ELECTRIC HEATING		AUXILIARIES		ELECTRIC	MAINT.	OPERATION
	HEATING (MCF)	COST ($)	DEMAND KW	ENERGY KWH	DEMAND (KW)	ENERGY (KWH)	COST ($)	COST ($)	TOTAL COST ($)
JAN	214.1	$1,070	0	529	50	4,123	$617	$0	$1,688
FEB.	173.4	$867	0	428	50	3,982	$614	$0	$1,481
MAR	126.3	$631	0	312	49	3,810	$558	$0	$1,189
APRIL	32.1	$161	0	79	15	1,494	$197	$0	$357
MAY	0.0	$0	0	0	0	0	$0	$0	$0
JUNE	0.0	$0	0	0	0	0	$0	$0	$0
JULY	0.0	$0	0	0	0	0	$0	$0	$0
AUG.	0.0	$0	0	0	0	0	$0	$0	$0
SEPT.	0.0	$0	0	0	0	0	$0	$0	$0
OCT.	32.1	$161	0	79	13	1,365	$207	$0	$368
NOV.	98.5	$492	0	243	49	3,699	$541	$0	$1,033
DEC	177.7	$888	0	439	50	3,997	$564	$0	$1,453
TAX		$0					$0	$0	$0
TOTAL	854	$4,271	0	2,110	276	22,470	$3,298	$0	$7,568

ANNUAL COOLING & HEATING

GAS		ELECTRIC			WATER		MAINT.	TOTAL
USAGE (MCF)	COST ($)	DEMAND PEAK (KW)	ENERGY (KWH)	COST ($)	USAGE (GAL)	COST ($)	COST ($)	COST ($)
2,116	$9,002	54	70,681	$9,561	228,690	$492	$1,050	$20,105

BUILDING N0N-HVAC ELECTRIC & GAS COST ANALYSIS

BUILDING ELECTRIC COST

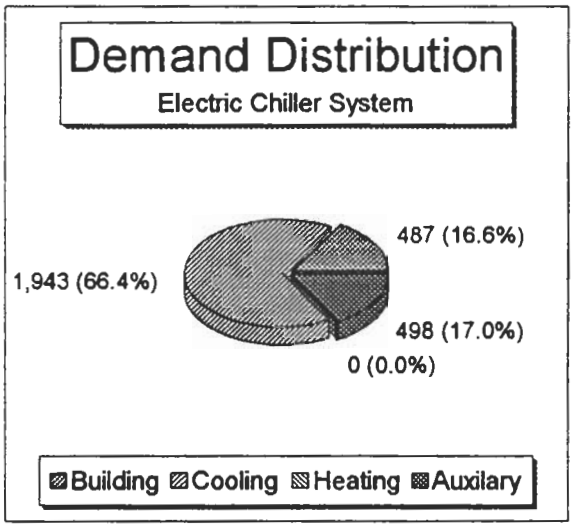
MONTH	DEMAND COST	ENERGY COST	TOTAL COST
JAN	$308	$568	$876
FEB.	$308	$532	$840
MAR	$308	$518	$826
APR	$308	$504	$812
MAY	$308	$555	$864
JUN.	$308	$577	$885
JULY	$403	$781	$1,184
AUG.	$360	$720	$1,080
SEPT.	$394	$748	$1,142
OCT.	$310	$644	$954
NOV.	$308	$454	$762
DEC	$308	$341	$649
TAX	$0	$0	$0
TOTAL	$3,932	$6,941	$10,873

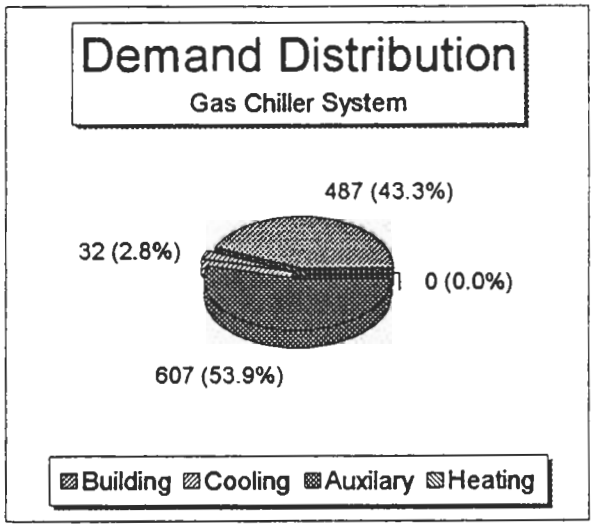
Lights, computers, clocks, machinery, etc.

BUILDING GAS COST

MONTH	COST
JAN	$85
FEB.	$85
MAR	$85
APR	$85
MAY	$70
JUN.	$70
JULY	$70
AUG.	$70
SEPT.	$70
OCT.	$70
NOV.	$85
DEC	$85
TAX	$0
TOTAL	$930

Domestic hot water





2,927 KW = Total Annual Demand = 1,136 KW

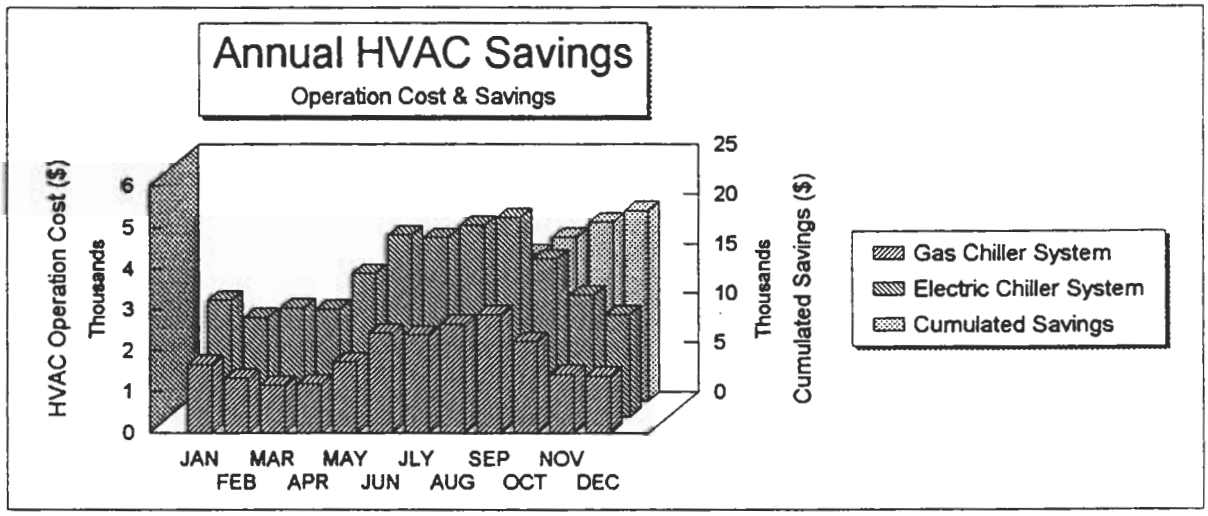
SUMMARY OF CHILLER ANALYSIS

FOR

Walnut Hill United Methodist

SYSTEM	ELECTRIC	GAS
COOLING		
TONNAGE	150	150
TON-HOURS	151,214	151,214
OPERATION COST	**$36,676**	**$16,030**
COST per SQ.FT.	$0.71	$0.31
HEATING		
HEATING LOAD (Mbh)	1,185	1,185
HEATING F.L. HOURS	381	381
OPERATION COST	**$4,980**	**$6,378**
COST per SQ.FT.	$0.10	$0.12
TOTAL HVAC OPERATION COST	**$41,656**	**$22,408**
BUILDING NON-HVAC GAS COST	$930	$930
BLDG. NON-HVAC ELECTRIC COST	$8,819	$8,819
TOTAL BLDG. GAS & ELECT. COST	**$51,406**	**$32,157**

ANNUAL SAVINGS USING GAS EQUIPMENT **$19,249**



This report is an estimate of the operation cost of cooling and heating systems. Actual performance depends upon weather and equipment control and maintenance. No warranty, either expressed or implied, is given with respect to this analysis. The projected costs and savings are estimates and actual costs may vary.

ATTACHMENT 8a

RETURN ON INVESTMENT ANALYSIS

GAS CHILLER COST		$104,000
INSTALLATION COST		$75,000
	TOTAL	$179,000

ELECTRIC CHILLER COST		$50,000
INSTALLATION COST		$60,000
	TOTAL	$110,000

NET INCREMENTAL COST OF GAS CHILLER SYSTEM.....	$69,000
CASH INCENTIVE.....	$27,000
ANNUAL SAVINGS USING GAS CHILLER SYSTEM.....	$19,249

SIMPLE 100% PAY BACK TERM (YEARS)	2.2 YEARS
RETURN ON INVESTMENT (FIRST YEAR)	46% PERCENT

UTILITY RATES

GAS COMPANY:	**LONE STAR GAS**		**ELECTRIC COMPANY:**	**TU ELECTRIC**	
RATE:	**COMMERCIAL**		**RATE:**	**GS-1995**	
CUSTOMER CHARGE:	$10.00		CONTRACT KW:		KW
WINTER or STEP 1:	$5.00	per MCF	BILLED CONTRACT:	$1.00	/KW excess
SUMMER or STEP 2:	$4.00	per MCF	CUSTOMER CHARGE:	$14.00	
		per MCF	BILLED DEMAND:	$8.45	/KW
AVERAGE GCA:		per MCF	MAX. of:	100%	ACTUAL *
				80%	ON-PEAK
ITCC CONTRACT:	YES			50%	ANNUAL PEAK
Spot Market:	$2.50	/MCF		50%	CONTRACT
Transportation:	$1.25	/MCF	ENERGY CHARGES:		
	-------		STEP 1:	$0.0621	/KWH
Total:	$3.75	/MCF	STEP 2:	$0.0320	/KWH
			STEP 3:	$0.0072	/KWH
WATER RATES for:			**EXTENDER:	170	KWH x (KW-10)
DALLAS, TEXAS			FUEL COST ADJUSTMENT:	$0.018926	/KWH
WATER/SEWER RATE:	$2.15	per KGAL	PCRF CHARGE:	$0.000000	/KWH

* Min. of "actual" KW or "on-peak" KW + 25% of excess KW over "on-peak" KW. ** Applies to STEP 2.

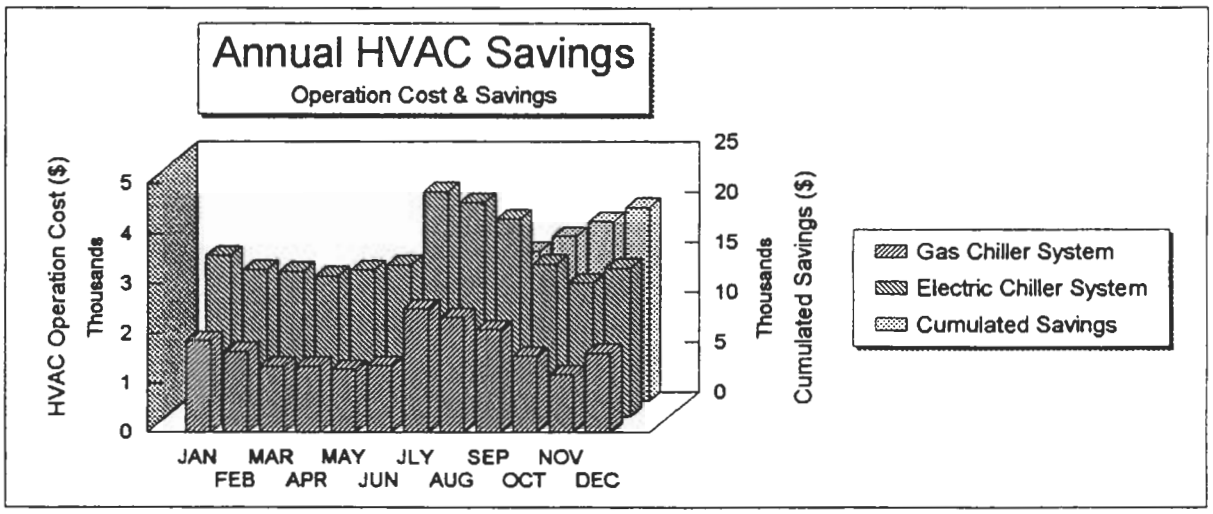
SUMMARY OF CHILLER ANALYSIS

FOR

Walnut Hill United Methodist

SYSTEM	ELECTRIC	GAS
COOLING		
TONNAGE	150	150
TON-HOURS	105,000	105,000
OPERATION COST	**$32,302**	**$12,537**
COST per SQ.FT.	$0.63	$0.24
HEATING		
HEATING LOAD (Mbh)	1,185	1,185
HEATING F.L. HOURS	599	599
OPERATION COST	**$7,186**	**$7,568**
COST per SQ.FT.	$0.14	$0.15
TOTAL HVAC OPERATION COST	**$39,488**	**$20,105**
BUILDING NON-HVAC GAS COST	$930	$930
BLDG. NON-HVAC ELECTRIC COST	$10,873	$10,873
TOTAL BLDG. GAS & ELECT. COST	**$51,291**	**$31,908**

ANNUAL SAVINGS USING GAS EQUIPMENT **$19,383**



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PRORATED OPERATING HOURS

WEATHER AREA: D/FW

FULL LOAD MONTHLY OPERATION HOURS

175 Cooling 150 Heating 240.16 Building 200 Auxilary

MONTH	COOLING		HEATING	BLDG.	AUXILIARIES				
	BASE	PEAKING		OPER.	CHW PUMP	CW PUMP	TOWER/ COND.FAN	A/H UNITS	HOT WATER PUMP
JAN	0%	1%	100%	100%	1%	1%	1%	100%	100%
FEB.	0%	1%	81%	100%	1%	1%	1%	100%	81%
MAR	0%	1%	59%	100%	1%	1%	1%	100%	59%
APRIL	0%	24%	15%	100%	25%	24%	24%	100%	15%
MAY	0%	37%	0%	100%	39%	37%	37%	100%	0%
JUNE	0%	40%	0%	100%	42%	40%	40%	100%	0%
JULY	0%	99%	0%	100%	104%	99%	99%	100%	0%
AUG.	0%	89%	0%	100%	93%	89%	89%	100%	0%
SEPT.	0%	76%	0%	100%	80%	76%	76%	100%	0%
OCT.	0%	30%	15%	100%	32%	30%	30%	100%	15%
NOV.	0%	1%	46%	100%	1%	1%	1%	100%	46%
DEC	0%	1%	83%	100%	1%	1%	1%	100%	83%

Notes: The sum of the Cooling Base + Peak percentages (%) should not exceed 100%.
Cooling = Chiller (KW or MCFH) x Cooling F.L. Hours x (%Base+%Peaking).
Heating = System (KW or MCFH) x Heating F.L. Hours x %Heating.
Building = Building Electric KW x Building F.L. Hours x %Bldg. Operation Hours.
Auxilary = Auxilary Electric KW x Each Pump or Fan x %Appropriate Pump or Fan Hours.